I-77 Feasibility Study (I-85 to Griffith Street)

TIP Project No. FS-0810B

Task Order No. 1 – I-77 Widening & HOV Facility Extension

Sub-task 1.C, Identification and Development of Issues Associated with I-77 HOV Facility Extension

TECHNICAL MEMORANDUM

(FINAL)

August, 2009

1.0 INTRODUCTION

1.1 PREVIOUS WORK

In January 2004, the North Carolina Department of Transportation (NCDOT) completed the I-77 High-Occupancy Vehicle (HOV) Operations Plan. This document summarized key policies, planning considerations, design elements, implementation issues, education and communication approaches, enforcement steps and monitoring and evaluation techniques required for the opening of North Carolina's first freeway HOV facility. The basis for the Plan was the *HOV Systems Manual*, *NCHRP Report 414*, which was published in 1998 by the Transportation Research Board. The NCHRP report identifies key elements to achieving desired project goals and objectives based on experience of other HOV projects across the country.

In 2003 and 2004, the I-77 HOV Operations, Education & Outreach Committee – an interagency committee established to coordinate HOV activities among various branches of NCDOT, the Federal Highway Administration (FHWA), the City of Charlotte, the contractor and designer for I-77 improvements, and enforcement agencies – commented on issues such as hours of HOV facility operation, vehicle occupancy and eligibility, and endpoints of HOV facility designation during development of the HOV Operations Plan. Input from this committee has been the basis for I-77 HOV facility operations for the past four years, and applicable policies and operating procedures will be re-assessed as described below in the current feasibility study for extending the HOV lanes to Exit 30 in Davidson.

1.2 CURRENT ANALYSIS

This sub-task under Task Order 1, which represents the feasibility assessment of HOV facility extension, reviews I-77 corridor design attributes, forecasted demand, and adopted objectives in order to identify issues associated with extending the general purpose and HOV lanes north to Griffith Street, exit 30 at Davidson.

Under sub-task 2.C in Task Order 2, a similar review and issues identification will be performed related to possible conversion of the existing or extended HOV facility to high-occupancy toll (HOT) lanes.

The next section recommends possible resolutions to the preliminary issues related to the widening of I-77 to six lanes and the extension of the HOV facility to Griffith Street.

2.0 POTENTIAL RESOLUTION OF IDENTIFIED ISSUES AND CONSIDERATIONS

Possible solutions to operating issues for I-77 HOV facility extension are discussed by category in the following sub-sections, based on available data and experiences from other projects.

2.1 HOV FACILITY ACCESS AND TERMINI

Issue:

What are appropriate and optional termini for inbound and outbound lanes? What operational issues should most drive this determination?

Recommended Resolution:

Typically, an HOV lane begins as an added lane next to the median. This approach is used because enforcement problems can be created if a general purpose lane becomes a restricted HOV lane, and unfamiliar drivers are inadvertently found in the segment of roadway with the lane restriction.

An HOV lane can be terminated in one of two ways—either by a left side lane drop or by dropping the lane restriction and subsequently dropping a right side lane to an exit only condition at a downstream ramp. The determination of which approach to take depends on the amount of weaving and merging created under the two scenarios. If there is a high downstream exiting volume to an off-ramp and a rather high forecast HOV volume that would continue along the route, carrying the lane and not dropping it on the left can be more operationally appropriate and safer from a weaving and merging perspective. Otherwise a lane drop on the left is preferable, particularly if forecast peak hour volumes are below 1000 vehicles.

Estimated HOV lane volumes used in the analysis of termini locations will be generated by the Metrolina travel demand model. The model takes into consideration the attractiveness of the HOV facility to motorists in the I-77 corridor when projecting travel demand for the special lanes.

Issue:

Should HOV facility access be unrestricted or provided only at designated locations?

Recommended Resolution:

Access should attempt to match other HOV lane treatments in the same corridor. In this case, access to and from I-77 concurrent HOV lanes is restricted in some high-weave sections and in the approach to the separate roadway and connector through the I-77/I-85 interchange. If the candidate freeway does not currently have an HOV lane, then a number of other attributes are considered including the magnitude of HOV demand, trip patterns, whether the HOV lane is full-time or part-time and whether the design lends itself to access restrictions. If pricing is contemplated in the future, then access restrictions would need to be considered.

2.2 DESIGN

Issue:

Any preliminary design studies performed for either general purpose lane widening or HOV lanes?

Recommended Resolution*:*

In 2003, NCDOT completed a feasibility study for the proposed widening of I-77 from the I-3311B project, which ends south of NC-73 at Huntersville, to I-40 near Statesville in Iredell County. This study addressed interstate widening from the four-lane existing freeway to an eight-lane facility. NCDOT Division 10 staff has analyzed adding one general purpose lane in each direction between the end of the existing widening at Exit 23 and Exit 30 by widening into the median. There is enough space in the median to accommodate this widening of the interstate.

Issue:

Use the same design as the current HOV lanes or should changes be considered in lane, buffer or shoulder widths?

Recommended Resolution:

The prevailing strategy would be to use the same lane, shoulder and buffer dimensions applied elsewhere in the I-77 HOV lane section for testing HOV feasibility for this portion of the corridor. Inside shoulder widths may vary based on prevailing median widths, but should be a minimum of 10 feet.

Issue:

Should conceptual signing or pavement markings follow current project?

Recommended Resolution:

Conceptual signing should meet the latest federal Manual on Uniform Traffic Control Devices (MUTCD) - 2003 edition requirements. Current HOV project signing meets these requirements. Rulemaking is currently pending for the 2009 MUTCD. This rulemaking would impose additional changes in signing only if an HOV lane in this section transitions to a HOT lane on the existing section. Transitional signing requirements have been added.

Pavement markings should be consistent with the current HOV lane project although buffer widths could vary from two feet to four feet depending on how the HOV lane fits within the available widening envelope in the median.

Issue:

What pavement surface treatment changes may be necessary in conjunction with widening (i.e., roto-milling and overlaying pavement and restriping) if typical section changes?

Recommended Resolution:

The only scenario where a typical section may change is if the HOV extension is intended to become a HOT lane in the future. For this case, the pavement markings should account for a buffer and removal of HOV diamonds on the pavement because these markings are not allowed for HOT lanes based on current MUTCD rulemaking. The existing corridor has asphalt pavement, and changes in pavement crown and

pavement markings may occur if the lane addition cannot be fully accommodated within the median. In such instance an overlay may be the most prudent approach to realigning both pavement markings and in addressing drainage and crown issues.

Issue:

What, if any, additional illumination is needed?

Recommended Resolution:

In addition to standard illumination at ramps, illumination is recommended at the project terminus northbound if a left side lane drop occurs and in offset median barrier locations where enforcement monitoring is provided

Issue:

Are there needs for traffic detection in pavement, cameras, or other Intelligent Transportation System (ITS) considerations?

Recommended Resolution:

Closed circuit television (CCTV) is recommended along the limits of the HOV lane to help monitor traffic flow and improve responsiveness to incidents.

Pavement loops are recommended at frequent intervals to segregate flow in the HOV lane from other lanes, in order to be able to better monitor operations and promote improved evaluation reporting.

Issue:

Will any existing sign structures near gore points need replacement (or modification)?

Recommended Resolution:

Existing sign bridge structures offer effective locations to place regulatory and guide signing related to the HOV lanes, but the weight calculations for such structures may not permit added signs. The feasibility study will need to gather input from applicable NCDOT branches and divisions to develop recommendations for signing and associated costs from the I-77 HOV lane extension.

2.3 OPERATIONS

Issue:

What operational factors could alter project limits?

Recommended Resolution:

On the north end of the corridor, the transition from HOV lanes back into the existing roadway section should not create a new bottleneck or degrade existing traffic operations. Forecasts and evaluations may show that improvements need to consider how traffic is loading and unloading onto the main lanes in the vicinity of the project limits to determine the best way of terminating the added HOV lanes. This may require extending the improvements upstream to achieve the best operational balance.

The limits on the south end become an extension of the current HOV lanes and are unaffected. If the southern section is considered for HOT lanes, then analysis in Task Order 2 will similarly evaluate transitional issues between the differing lane restrictions.

Issue:

Should the extension have the same or a different operating policy as the current HOV lanes?

Recommended Resolution:

The existing operational policy for I-77 HOV lanes will be re-assessed based on traffic forecasts for the extension and the current use of the existing facility south of I-485. In general, the same operation policy should hold true for HOV lane extensions within a corridor, but there may be current issues that need to be addressed as part of the baseline coding assumptions for the extension.

Issue:

What should be minimum vehicle and person demand conditions for opening year? Design year?

Recommended Resolution:

Unless otherwise noted based on demand estimates, the minimum vehicle and person demand for the opening year will be based on a 2+ occupancy requirement with the same exemptions now provided to motorcycles and other vehicle classes. The minimum threshold for HOV viability would be assumed to be the same as for the current I-77 HOV lanes (about 400 vehicles/hour initially) and parity with a general purpose lane (about 1000 vehicles per hour or more) by the design year of 2030.

Issue:

What should be the minimum speed differential or time savings threshold for this segment?

Recommended Resolution:

The minimum speed differential or travel time savings threshold for this segment should be equivalent to about 0.5 minutes per mile for the incremental affected distance which is restricted to HOV lane users.

Issue:

What should be current and forecasting peak operating conditions?

Recommended Resolution:

Under existing peak period operating conditions, congestion should be occurring along portions of the corridor to warrant consideration of an HOV lane extension.

Under forecasted 2030 peak period operating conditions, motorists should be experiencing congestion for a majority of the study limits. Under the department's draft Mobility Performance Measures, NCDOT defines congestion as *"the time duration which prevailing speed vehicles on a given roadway section averages less than 40 miles per hour".*

Issue:

Are there any special enforcement needs? Are shoulders available?

Recommended Resolution:

The HOV extension will rely on manual occupancy enforcement because there is presently no automated means to handle occupancy infractions. Special enforcement

needs must consider some level of dedicated enforcement and be accounted for in project implementation costs, regardless of the funding source.

Availability of median (inside) shoulders, which are nominally 10 feet to 14 feet wide, should be evaluated in both directions for the entire project limits. This is in addition to outside shoulders which should be maintained for any HOV lane alternative.

Issue:

Are there any incident management needs?

Recommended Resolution:

The current HOV lanes do not have unique incident management needs or protocols within NCDOT's Metrolina Regional Traffic Management Center (MRTMC). As long as the selected HOV concept is concurrent lanes with no physical barrier to adjacent lanes, this practice would be appropriate as an assumption for O&M costs for the HOV lane extension. If the concept is different from the current operation and design, then different incident management may be required, particularly if the HOV lane is physically separated and difficult to access.

Issue:

Are there transit operations needs?

Recommended Resolution:

Existing and proposed transit operations and transit markets in the corridor may dictate specific routings that could be adversely affected if access restricts transit movements. Transit plans (and needs) will need to be accounted for in access restrictions. Unless transit volumes are extraordinary, approaching 15-20 bus trips in the peak hour, no dedicated median transit or HOV-only ramps would be contemplated along the HOV lanes.

2.4 PHASING

Issue:

What other planned or programmed projects in the corridor affect phasing or implementation of extension of the general purpose and/or HOV lanes?

Recommended Resolution:

NCDOT has programmed no projects along I-77 to Exit 30 that would influence timing and phasing for any HOV lane extension, including pavement maintenance, interchange upgrades, ITS and others.

Augustalee, a major proposed mixed-use development in Cornelius, includes the widening on I-77 from four to six lanes from south of Exit 23 (Gilead Road) to Exit 28 (Catawba Avenue). On April 29, 2009, the Mecklenburg-Union Metropolitan Planning Organization (MUMPO) amended the Transportation Improvement Program (TIP) to include I-77 widening related to the Augustalee project. MUMPO's approval of the TIP amendment included the preference that the new I-77 lanes be constructed as **managed lanes**. Another transportation improvement included in this new development is construction of a new interchange on I-77 at Westmoreland Road. The developer is currently preparing the required Interchange Justification Report (IJR) for approval by the Federal Highway Administration (FHWA) and NCDOT.

Issue:

What are factors influencing how implementation is evaluated (i.e., implementation of transit services, other corridor maintenance or improvement needs, etc.)?

Recommended Resolution:

Criteria normally considered for phasing relates to where HOV demand loads, particularly transit services, in the corridor (in this case examining options from south to north as the existing HOV lanes are extended).